



Estuary 15: Westbrook

Watershed Summary

WATERSHED DESCRIPTION AND MAPS

The Westbrook Estuary (Estuary 15) covers an area of approximately 6,884 acres along the coast of south central Connecticut. These impaired segments are located in the central portion of Long Island Sound (LIS). All of the impaired segments in this estuary are located in the municipality of Westbrook, CT with the headwaters of the rivers in Clinton.

The Westbrook Estuary includes five segments impaired for direct shellfish harvesting due to elevated bacteria levels. These segments were assessed by Connecticut Department of Energy and Environmental Protection (CT DEEP) and included in the CT 2016 303(d) list of impaired waterbodies. Some segments in the estuary are currently unassessed as of the writing of this document. This does not mean there are no potential issues on these segments, but indicates a lack of current data to evaluate the segments as part of the assessment process. An excerpt of the Integrated Water Quality Report is included in Table 1 (CT DEEP, 2016).

Impaired Segments

Segment 1: LIS CB Inner - Patchogue And Menunketesuck Rivers (CT-C1_001) is in the central portion of LIS Inner Estuary, Patchogue and Menunketesuck Rivers from mouths at Grove Beach Point, US to saltwater limits just above I95 crossing, and at I95 crossing respectively, in Westbrook.

Segment 2: LIS CB Shore - Westbrook Harbor (East), Westbrook (CT-C2_001) is in the central portion of LIS from Fiske Lane to Old Saltworks Road (includes Middle Beach), out approximately 1000 ft offshore in Westbrook.

Segment 3: LIS CB Shore – Westbrook Harbor (CT-C2_002) is in the central portion of LIS from Portside Drive near Patchogue River outlet to Fiske Lane (includes Westbrook Town Beach), out approximately 1000 ft offshore in Westbrook.

Impaired Segment Facts

Impaired Segments, Classifications, and Areas (square miles):

Segment 1: LIS CB Inner - Patchogue and Menunketesuck Rivers (CT-C1_001); SA; 0.182

Segment 2: LIS CB Shore - Westbrook Harbor (East), Westbrook (CT-C2_001); SA; 0.244

Segment 3: LIS CB Shore - Westbrook Harbor (West), Westbrook (CT-C2_002); SA; 0.231

Segment 4: LIS CB Midshore - Westbrook Harbor, Westbrook (CT-C3_001); SA; 2.692

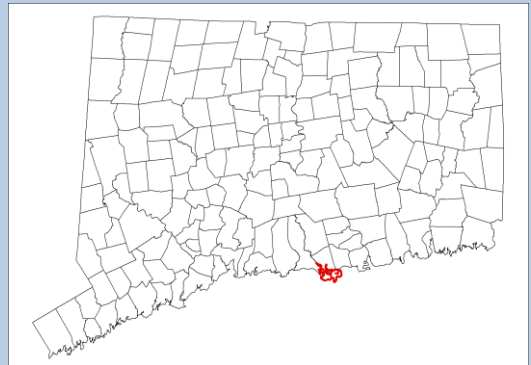
Segment 5: LIS EB Midshore - Westbrook (CT-E3_012); SA; 7.407

Municipalities: Westbrook

Designated Use Impairments: Shellfish

MS4 Applicable? Yes

Applicable Season: Year Round



Segment 4: LIS CB Midshore - Westbrook Harbor, (CT-C3_001) is in the central portion of LIS from approximately 1000 ft offshore (Westbrook Harbor), out to 50 ft contour and basin boundary separating Eastern/ Central.

Segment 5: LIS EB Midshore - Westbrook - Outer Westbrook Harbor (CT-E3_012) Eastern portion of LIS from approximately 1000 ft offshore Old Kelsey Point (outer Westbrook Harbor), out to 50 ft contour.

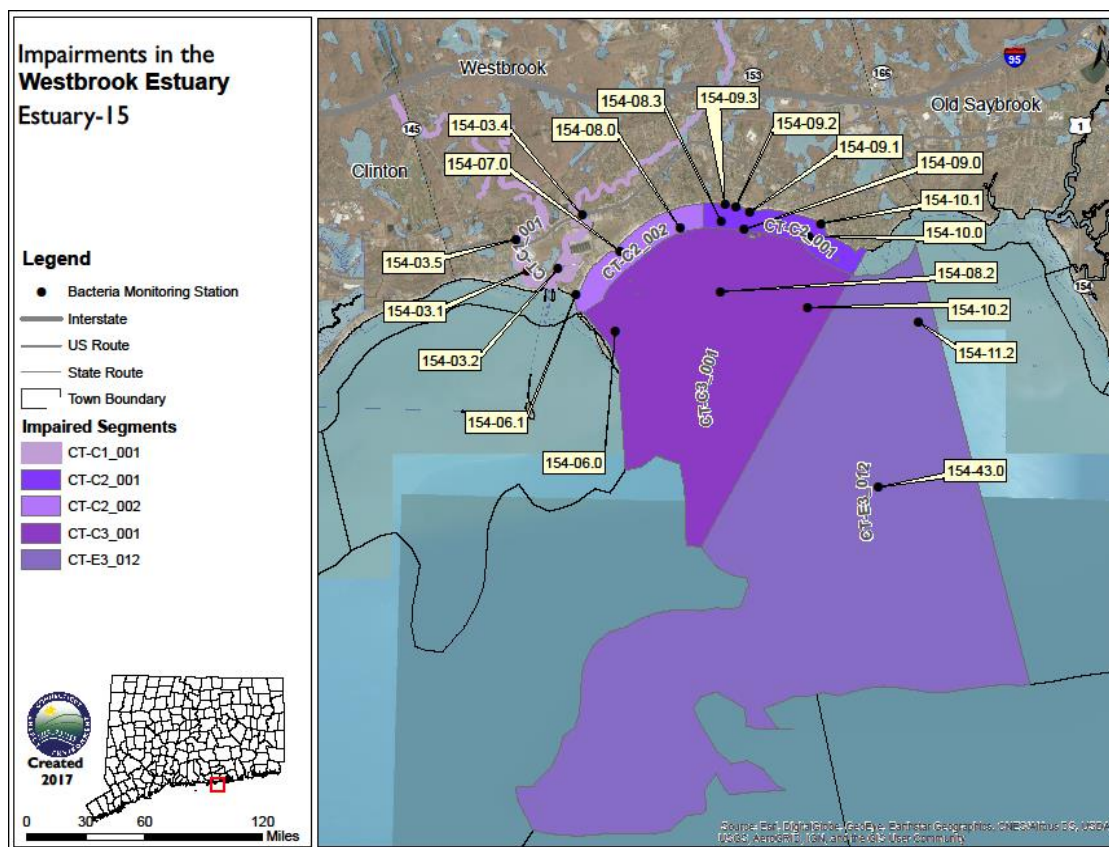
These 5 impaired segments of the Westbrook Estuary have a water quality classification of SA. Designated uses include habitat for marine fish, other aquatic life and wildlife; shellfish harvesting for direct human consumption; recreation; industrial water supply; and navigation. These segments of the estuary are impaired due to elevated bacteria concentrations, affecting the designated use of direct shellfishing.

Table 1: Impaired segments in the Westbrook Estuary from the Connecticut 2016 Integrated Water Quality Report

Waterbody ID	Waterbody Name	Location	Square Miles	Marine Aquatic Life	Recreation	Fish Consumption	Direct Shellfish	Commercial Shellfish
CT-C1_001	LIS CB Inner - Patchogue And Menunketesuck Rivers	Central portion of LIS, Inner Estuary, Patchogue and Menunketesuck Rivers from mouths at Grove Beach Point, US to saltwater limits just above I95 crossing, and at I95 crossing respectively, Westbrook.	0.182	U	U	FULL	NOT	///
CT-C2_001	LIS CB Shore - Westbrook Harbor (East), Westbrook	Central portion of LIS from Fiske Lane to Old Saltworks Road (includes Middle Beach), out approximately 1000 ft offshore, Westbrook.	0.244	U	FULL	FULL	NOT	///
CT-C2_002	LIS CB Shore - Westbrook Harbor (West), Westbrook	Central portion of LIS from Portside Drive near Patchogue River outlet to Fiske Lane (includes Westbrook Town Beach), out approximately 1000 ft offshore, Westbrook.	0.231	U	FULL	FULL	NOT	///

Waterbody ID	Waterbody Name	Location	Square Miles	Marine Aquatic Life	Recreation	Fish Consumption	Direct Shellfish	Commercial Shellfish
CT-C3_001	LIS CB Midshore - Westbrook Harbor, Westbrook	Central portion of LIS from approximately 1000 ft offshore (Westbrook Harbor), out to 50 ft contour and basin boundary separating Eastern/Central.	2.692	FULL	U	FULL	NOT	///
CT-E3_012	LIS EB Midshore - Westbrook	See Map for Boundaries. Eastern portion of LIS from approximately 1000 ft offshore Old Kelsey Point (outer Westbrook Harbor), out to 50 ft contour. Odd shape due to 50 ft contour.	7.407	FULL	U	FULL	NOT	///
Shaded cells indicate impaired segment addressed in this TMDL FULL = Designated Use Fully Supported NOT = Designated Use Not Supported U = Unassessed /// = Not Applicable to Segment								

Figure 1: GIS map featuring general information for impaired segments in the Westbrook Estuary



Shellfish Bed Classifications, Closures, and Lease Locations

The Connecticut Department of Agriculture/Bureau of Aquaculture (CT DA/BA) is responsible for regulating shellfish harvesting (www.ct.gov/doag/cwp/view.asp?a=1369&Q=259170). A shellfish growing area is defined by CT DA/BA as any area that supports or could support the growth and/or propagation of molluscan shellstock. Shellfish are defined by CT DA/BA as oysters, clams, mussels, and scallops, either shucked or in the shell, fresh or frozen, whole or in part. All shellfish growing areas are classified by CT DA/BA in accordance with the Interstate Shellfish Sanitation Conference (ISSC) National Shellfish Sanitation Program Model Ordinance (NSSP-MO) and CT General Statutes Chapter 491, §26-192e. These classifications, summarized below, are established to minimize health risks and may restrict the take and use of shellfish from some areas. They are based on fecal coliform bacteria standards as provided in the NSSP-MO (Interstate Shellfish Sanitation Conference, 2007). Any shellfish area, regardless of classification, may be temporarily closed to all activities when a potential public health emergency exists as a result of a storm event, flooding, sewage, chemical, or petroleum discharges, or a hazardous algal bloom.

Shellfish harvesting has been divided into two designated uses as specified in the Connecticut Water Quality Standards (WQS: shellfish harvesting suitable for direct human consumption (Class SA waters), and shellfish harvesting suitable for commercial operations requiring depuration or relay (Class SB waters). The impaired segments in the Westbrook Estuary are Class SA waters.

Shellfish classification areas in the Westbrook Estuary are shown in Figure 2. The following classifications for shellfish growing areas are defined by CT DA/BA:

APPROVED AREA: A classification used to identify a growing area that is safe for the direct marketing or consumption of shellfish. An area may be classified as Approved when a sanitary survey finds that there is no contamination from pathogenic organisms, poisonous or deleterious substances, marine biotoxins, or bacteria concentrations exceeding the bacteriological standards for a growing area in this classification as set forth in the NSSP MO. The water quality in the growing area shall also meet the bacteriological standards for an Approved classification.

CONDITIONALLY APPROVED AREA: Is a classification used to identify a growing area that is safe for the direct, marketing or consumption of shellfish when the area is in the open status. The area must meet the criteria for Approved classification when the area is in the open status, and meets the criteria for the restricted classification in the closed status. An area may be classified as Conditionally Approved when a sanitary survey finds that the area can remain in the open status for a reasonable period of time, the factors impacting the area are known and predictable and do not preclude a reasonable management approach, and the water quality correlates with the environmental conditions or other factors affecting the distribution of pollutants into the growing area. Each Conditionally Approved growing area must have a written management plan that is adhered to by all responsible parties.

CONDITIONALLY APPROVED SEASONAL AREA: Conditionally Approved Seasonal areas are closed under certain seasonal conditions, either due to the operations of marinas or mooring fields, or because the area may be subject to elevated bacteria levels during certain times of the year.

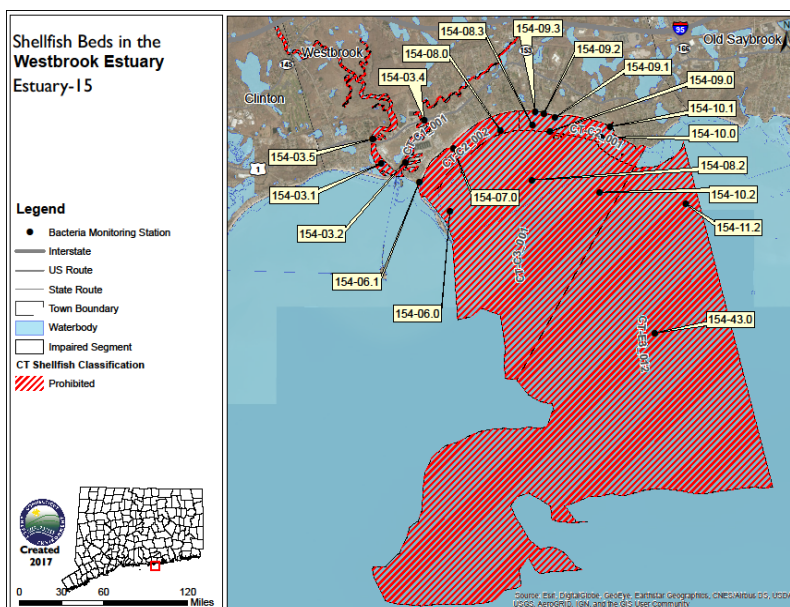
RESTRICTED: A growing area in which the sanitary survey finds there are levels of fecal pollution, human pathogens, or poisonous or deleterious substances that can be reduced by relaying the shellstock to Approved or Conditionally Approved waters for natural cleansing or depuration. Shellfish from these areas may not be directly harvested for market or consumption.

CONDITIONALLY RESTRICTED: Is a classification used to identify a growing area where a sanitary survey has found that the area meets the criteria for Restricted classification when the area is in the open status and meets the criteria for Prohibited classification when the area is in the closed status. Each Conditionally Restricted growing area must have a written management plan that designates whether harvested shellfish are relayed or depurated. Shellfish may only be harvested from Conditionally Restricted areas by special license, and may not be directly harvested for market or consumption.

PROHIBITED: Is a classification used to identify a growing area where there has been no current sanitary survey or where a sanitary survey has found that the area is adjacent to a sewage treatment plant or other point source outfall with public health significance; pollution sources may unpredictably contaminate the growing area; the growing area is contaminated with fecal waste so that the shellfish may be vectors for disease microorganisms; and/or that the concentration of biotoxin is sufficient to cause a public health risk. Shellfish may not be harvested from Prohibited areas except for seed oystering or depletion of the areas.

As discussed above and shown in Table 1, Segments 1 – 5 did not meet their designated use for shellfish harvesting for direct consumption due to bacteria (Table 1). Shellfish beds in Westbrook are closed and classified as Prohibited.

Figure 2: GIS map featuring Shellfish Bed Classifications and Closures for the impaired segments in the Westbrook Estuary



Shellfish Bed Lease Locations

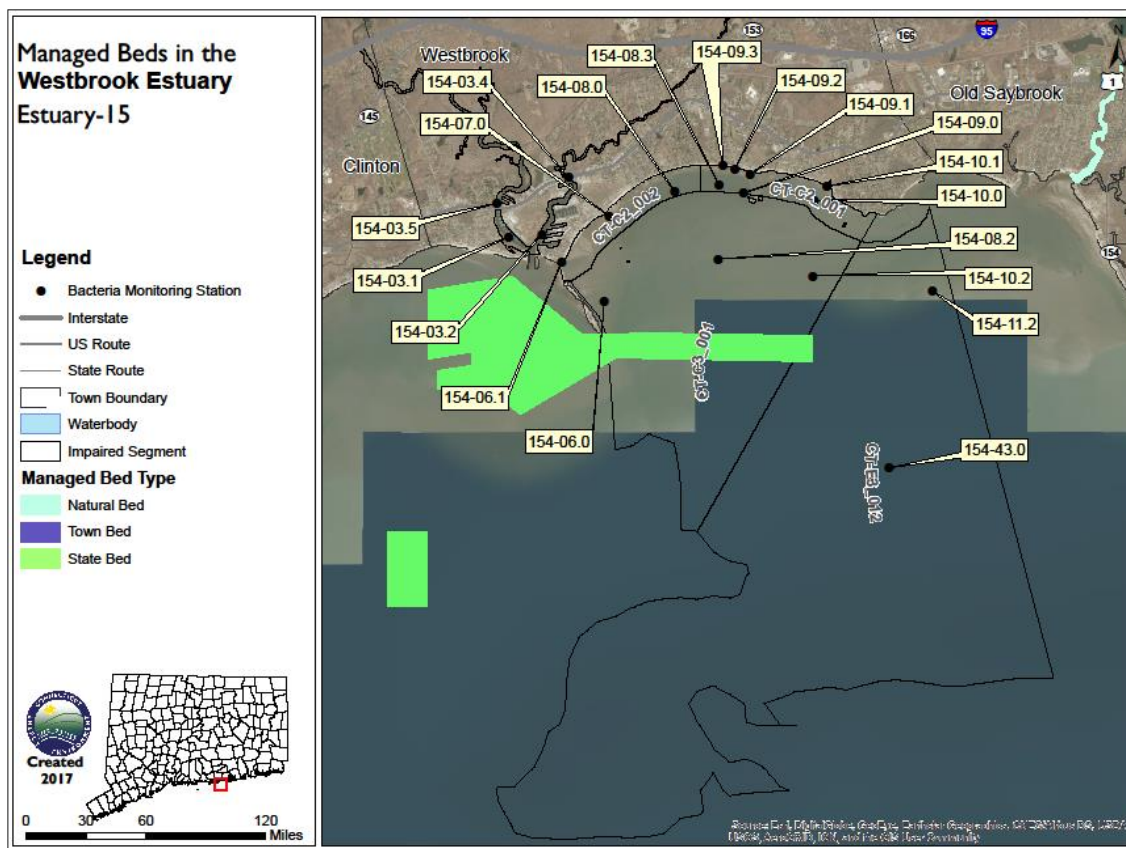
Shellfish beds in the Westbrook Estuary are also classified by their management (Figure 3). CT DA/BA defines these areas as follows:

State and Town Beds: In 1881, a line, referred to as the Commissioner's Line, was established to divide the waters of the State into northern and southern sections. All beds south of this line are State beds and most beds north of this line are town beds. Town beds are leased, owned or managed through the local shellfish commission. However, CT DA/BA still controls all the licensing and regulations for both state and town beds. For example, DA/BA issues licenses and determines when an area will be closed to shellfishing due to a change in water quality. Towns may require additional permits to work in waters under local jurisdiction. Beds north of the line in Westport, Milford, West Haven, and New Haven are exceptions to this as they are fully under State control.

State and Town Natural Beds: Natural beds get their name from the fact that shellfish, especially oyster, naturally inhabited the area. These areas tend to be closer to shore, usually at the mouth of a river. Natural beds have specific regulations concerning their use, including licensing and harvesting methods. They are predominately seed beds that cannot be mechanically harvested. Use of natural beds requires a Relay/Transplant License I or II and/or Seed Oyster Harvesting License from CT DA/BA. Any person assisting in the harvesting of seed oysters must have a Helper's License. These beds cannot be leased or subdivided; they are to remain open to any properly licensed harvester. State natural beds are natural beds south of the Commissioner's Line. Descriptions of these beds can be found in §3295 of the Connecticut General Statutes (CGS), revision of 1918. Not all beds listed in §3295 were mapped, and many natural beds in State waters off Greenwich are managed through leases. Town natural beds were defined by law under §2326 of the CGS of 1888. Each town had the opportunity to map areas to be considered natural beds. The documents, written descriptions, and maps were submitted to the Superior Court with jurisdiction for that town. Several towns did not avail themselves to this opportunity, and some, such as Westport, have changed the delineation of their natural beds in recent court decisions. There are also areas that may have been declared natural beds, but are now leased.

Portions of Segments 4 (CT-C3_001) and Segment 5 (CT-E3_012) are State-managed beds (Figure 3). There are no natural shellfish beds in the Westbrook Estuary. The Town managed beds in Westbrook are closed and classified as “Prohibited”.

Figure 3: GIS map featuring Shellfish Bed Lease Locations for the impaired segments in the Westbrook Estuary



WHY IS A TMDL NEEDED?

For saltwater segments, the indicator bacteria, fecal coliform, is used in the CT Water Quality Standards (WQS) to assess shellfish uses for Class SA and SB waters (CTDEEP, 2013). Enterococcus is the indicator bacteria used to assess recreational uses for Class SA and SB waters. All data are from CT DEEP, USGS, Bureau of Aquaculture, or volunteer monitoring efforts at stations located on the impaired segments.

Segments 1 – 5 are Class SA saltwater waterbodies. Their applicable designated uses include shellfish harvesting for direct human consumption, recreation, habitat for marine fish and other aquatic life and wildlife, industrial water supply, and navigation. Water quality analyses were conducted using data from four sample locations on Segment 1 (CT-C1_001), seven sampling locations on Segment 2 (CT-C2_001), three sampling locations on Segment 3 (CT-C2_002), three sampling locations on Segment 4 (CT-C3_001), and two sampling locations on Segment 5 (CT-E3_012). The water quality criteria for fecal coliform, along with bacteria sampling results from 2000 – 2011, are presented in Tables 11-15. These segments of the estuary are impaired due to elevated bacteria concentrations, affecting the designated use of direct shellfishing.

To aid in identifying possible bacteria sources, the geometric mean was also calculated for wet-weather and dry-weather sampling days for all stations, where possible (Tables 11 and 15).

Segment 1 (CT-C1_001): As shown in Table 11, geometric means for data collected during the sampling period were calculated for each station using wet and dry-weather conditions, resulting in exceedances of WQS for fecal coliform during both wet-weather and dry-weather. All 6 years of monitoring at the station near the mouth of the Menunketesuck River (154-03.1) showed exceedances of water quality criteria. Results reported at the other stations in this segment also showed water quality exceedances most years.

Segment 2 (CT-C2_001): As shown in Table 12 geometric means for data collected during the sampling period were calculated for each station using wet and dry-weather conditions, resulting in exceedances of WQS for fecal coliform during both wet-weather and dry-weather. There is one designated swimming area in this segment, Middle Beach, this beach did not report any closures for swimming from 2007-2012. According to the 2003 Westbrook report completed by DA/BA, stations 154-9.1, 9.2, and 9.3 were established to monitor water quality for shellfishing at storm drain outfalls between Quotonset and Middle beaches. There were exceedances of water quality criteria at these 3 locations during wet and dry conditions. Station 154-10-1 was established to monitor the small tidal creek at Money Point. This location was only sampled during dry conditions and water quality was exceeded 3 times from 2002-2005.

Segment 3 (CT-C2_002): There is one designated swimming area in this segment, West Beach. This beach was preemptively closed for 5 days in 2009 and for 7 days in 2010. As shown in Table 13, monitoring results exceeded water quality criteria for shellfishing only once at stations 154-06.1 and 154-08.0 and twice at location 154-07.0. The Geometric mean values exceeded the WQS for fecal coliform for shellfishing twice at station 154-07.0, once at station 154-06.1 and once also at 154-08.0. Although there were Geomean exceedances some years, geometric means for all samples collected during wet and dry-weather did not exceed the WQS for fecal coliform at any station.

Segment 4 (CT-C3_001): As shown in Table 14, the Geomean at Station 154-10.2 and station 154-08.2 were exceeded once at each station during dry weather in 2008. 154-10.2 is located off Salt Works Bay and 154-08.2 monitors water quality off Westbrook Harbor. Although there were Geomean exceedances in individual years, and one exceedance of WQS in an individual sample during wet weather the geometric means for wet and dry-weather did not exceed the WQS for fecal coliform at any station.

Segment 5 (CT-E3_012): As shown in Table 15, geometric mean for data collected during the sampling period were calculated for two stations using wet and dry-weather conditions. Although there was one Geomean exceedance in 2005 at 154-43.0, geometric means for wet and dry-weather did not exceed the WQS for fecal coliform at either station. 154-11.2 monitors water quality off Old Kelsey Point; there were no exceedances of water quality criteria reported at this location during the 9 years of monitoring.

Due to the elevated bacteria measurements presented in Tables 11 – 15, these five impaired segments did not meet CT's bacteria WQS, were identified as impaired, and were placed on the CT List of Waterbodies Not Meeting Water Quality Standards, also known as the CT 303(d) Impaired Waters List. The Clean Water Act requires that all 303(d) listed waters undergo a TMDL assessment that describes the impairments and identifies the measures needed to restore water quality. The goal is for all waterbodies to comply with State WQS.

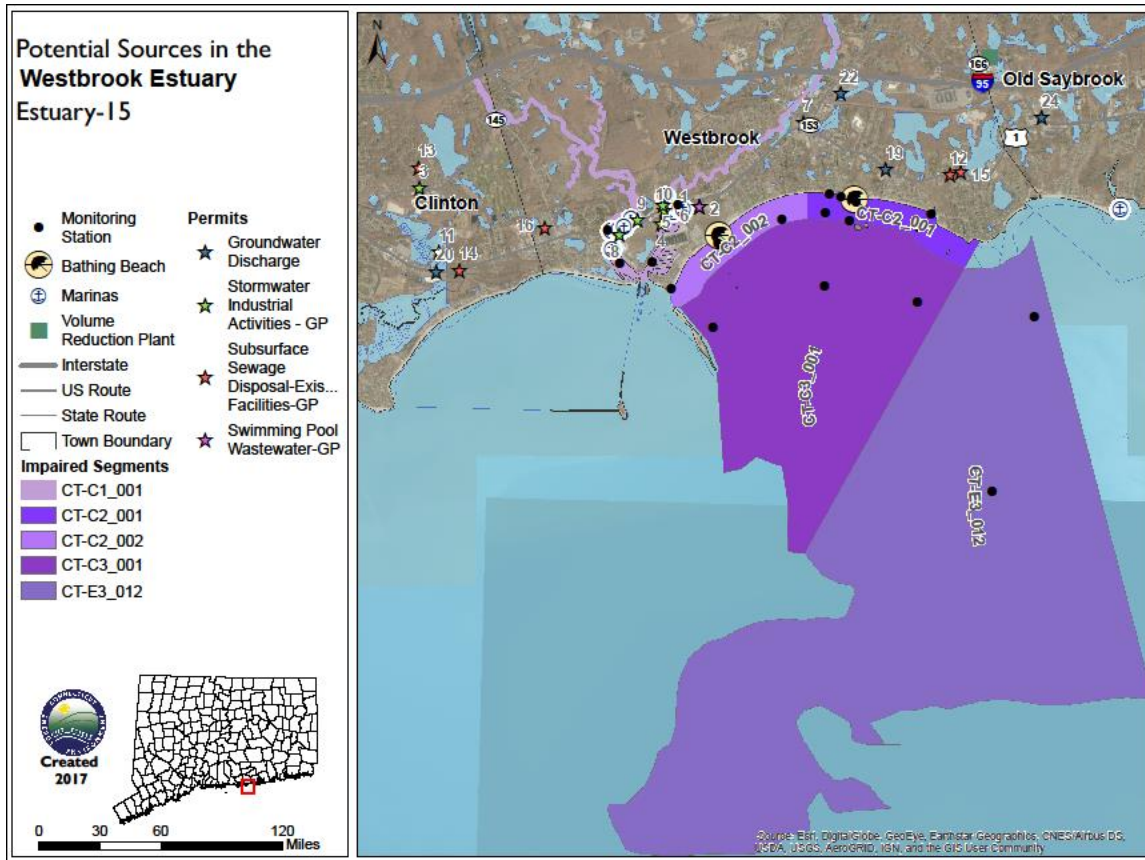
Table 2: Sampling station location for the impaired segments in the Westbrook Estuary

Waterbody ID	Station	Municipality	Latitude	Longitude
CT-C1_001	154-03.1	Westbrook	41.271833	-72.475383
	154-03.2	Westbrook	41.272033	-72.470817
	154-03.4	Westbrook	41.27795	-72.467167
	154-03.5	Westbrook	41.275317	-72.477017
CT-C2_001	154-10.0	Westbrook	41.2755	-72.433517
	154-10.1	Westbrook	41.27695	-72.431783
	154-08.3	Westbrook	41.277167	-72.446567
	154-09.0	Westbrook	41.276283	-72.443217
	154-09.1	Westbrook	41.278233	-72.442317
	154-09.2	Westbrook	41.278817	-72.4444
	154-09.3	Westbrook	41.279117	-72.446
CT-C2_002	154-06.1	Westbrook	41.269217	-72.468167
	154-07.0	Westbrook	41.27395	-72.461633
	154-08.0	Westbrook	41.276483	-72.452667
CT-C3_001	154-06.0	Westbrook	41.265083	-72.462333
	154-08.2	Westbrook	41.269433	-72.4467
	154-10.2	Westbrook	41.267667	-72.4338
CT-E3_012	154-11.2	Westbrook	41.266017	-72.4174
	154-43.0	Westbrook	41.247717	-72.423433

POTENTIAL BACTERIA SOURCES

Potential sources of indicator bacteria in a watershed include point and non-point sources, such as stormwater runoff, agriculture, sanitary sewer overflows (collection system failures), illicit discharges, and inappropriate discharges to the waterbody. Potential sources that have been tentatively identified in the Westbrook Estuary are presented in Table 3 and Figure 4. However, the list of potential sources is general in nature and should not be considered comprehensive. There may be other sources not listed here that contribute to the observed water quality impairment in the study segments. Further monitoring and investigation will confirm listed sources and discover additional ones. Some segments in this watershed are currently listed as unassessed by CT DEEP procedures. This does not mean that there are no data or impairments in existence in the segment. There are data from permitted sources for some segments, and CT DEEP recommends that any elevated concentrations found from those permitted sources be addressed through voluntary reduction measures. More detailed evaluation of potential sources is expected to become available as activities are conducted to implement these TMDLs.

Figure 4: Potential bacteria sources to the impaired segments in the Westbrook Estuary



The potential sources map for the impaired basin was developed after thorough analysis of available data sets. If information is not displayed in the map, then no sources were discovered during the analysis. The following is the list of potential sources that were evaluated: problems with migratory waterfowl, golf course locations, reservoirs, proposed and existing sewer service, cattle farms, poultry farms, permitted sources of bacteria loading (surface water discharge, MS4 permit, industrial stormwater, commercial stormwater, groundwater permits), and leachate and discharge sources (agricultural waste, Combined Sewer Overflow (CSO), failing septic systems, landfills, large septic tank leach fields, septage lagoons, sewage treatment plants, and water treatment or filter backwash).

Table 3: Potential bacteria sources to the impaired segments in the Westbrook Estuary

Segment #	Impaired Segment	Permit Source	Illicit Discharge	CSO/SSO Issue	Failing Septic System	Marinas	Stormwater Runoff	Nuisance Wildlife/Pets	Other
1	CT-C1_001	x			x	x	x	x	
2	CT-C2_001	x			x	x	x	x	
3	CT-C2_002	x			x	x	x	x	
4	CT-C3_001	x			x	x	x	x	
5	CT-E3_012	x			x	x	x	x	

Point Sources

Permitted sources within the watershed that could potentially contribute to the bacteria loading are identified in Table 4. This table includes permit types that may or may not be present in the impaired watershed. Table 5 is a list of active permits in Westbrook. Additional investigation and monitoring could reveal the presence of other discharges in the estuary.

Table 4: General categories list of permitted discharges

Permit Code	Permit Description Type	Number in Estuary
CT	Surface Water Discharges	0
GPL	Discharge of Swimming Pool Wastewater	2
GSC	Stormwater Discharge Associated with Commercial Activity	0
GSI	Stormwater Associated with Industrial Activity	9
GSM	Part B Municipal Stormwater MS4	1
LF	Groundwater Permit	0
UI	Underground Injection	7
GSSD	Community Subsurface Sewer Disposal Systems	5

Permitted Sources

As shown in Table 5, there are multiple permitted discharges in Westbrook that could be contributing bacteria to the impaired segments. These facilities include some industrial facilities, the Town of Westbrook, and multiple marinas throughout the watershed. The marinas include Pilot's Point Marina, Harry's Marine, Pier 76, Brewer Pilot's Point, and Westbrook Marine. Harry's Marine, Pier 76, Ritt's Marine and Brewer Pilot's Point Marina are also listed as permitted sources in the Clinton Estuary TMDL.

Since the Municipal Separate Storm Sewer Systems (MS4) permits are not targeted to a specific location, but the geographic area of the regulated municipality, there is no one accurate location on the map to display the location of these permits, therefore the MS4 permit will not be displayed in the Potential Sources Map. Using the municipal border as a guideline will show which areas of an affected watershed are covered by an MS4 permit.

Table 5: Permitted facilities in Westbrook, CT that may be affecting the Westbrook Estuary

Town	Company	Permit ID	Permit Type	Site Name	Address	Map #
Clinton	Clinton Commons Shopping Center	UI0000118	Groundwater Discharge	Clinton Commons Shopping Center	266 E Main St	20
Clinton	The Moorings I Association, Inc.	GSSD000083	Subsurface Sewage Disposal-GP	The Moorings I	280 E Main St	14
Clinton	Nichols Auto Parts	GSI002503	Stormwater Industrial Activities - GP	Nichols Auto Parts	46 Meadow Rd	11
Westbrook	Pilots Point Marina, Inc.	GSI002132	Stormwater Industrial Activities - GP	Brewer Pilots Point Marina - North Yard	333 Boston Post Rd	8
Westbrook	Jensen's, Inc.	GSSD000156	Subsurface Sewage Disposal-GP	Grove Beach Residential Community	Grove Beach Rd and Boston Post Rd	16
Westbrook	Harry's Marine Repair, Inc.	GSI000462	Stormwater Industrial Activities - GP	Harry's Marine Repair, Inc.	38 Hammock Rd S	4
Westbrook	Louis Marine Ltd.	GSI002448	Stormwater Industrial Activities - GP	434 Boston Post Road	434 Boston Post Rd	9
Westbrook	Westbrook Marine Center, LLC	GSI002470	Stormwater Industrial Activities - GP	Westbrook Marine Center, LLC	533 Boston Post Rd	10
Westbrook	Pilots Point Marina, Inc.	GSI000907	Stormwater Industrial Activities - GP	Pilots Point Marina, Inc.	63 Pilots Point Dr	6
Westbrook	Pilots Point Marina, Inc.	GPL000219	Swimming Pool Wastewater-GP	Pilots Point Marina, Inc.	63 Pilots Point Dr	2
Westbrook	Pilots Point Marina, Inc.	GPL000167	Swimming Pool Wastewater-GP	Pilots Point Marina, Inc.	63 Pilots Point Dr	1

Town	Company	Permit ID	Permit Type	Site Name	Address	Map #
Westbrook	Pier 76, Inc.	GSI000496	Stormwater Industrial Activities - GP	Pier 76, Inc.	54 Old Boston Post Rd	5
Clinton	Mallace Industries Corp	GSI000308	Stormwater Industrial Activities - GP	Mallace Industries Corp	2 Heritage Park Rd	3
Westbrook	SKS Westbrook, LLC	GSSD000054	Subsurface Sewage Disposal-GP	Ambleside Apartments	1784 Boston Post Rd	12
Westbrook	Green Acres Associates, LLC	GSSD000152	Subsurface Sewage Disposal-GP	Green Acres Associates, LLC	1810 Boston Post Rd	15
Westbrook	DGG Properties Co.	UI0000087	Groundwater Discharge	Water's Edge Inn & Resort	1525 Boston Post Rd	19
Clinton	Victoria Manor Association, Inc.	GSSD000079	Subsurface Sewage Disposal-GP	Victoria Manor Association, Inc.	59 Old Post Rd	13
Westbrook	Aiudi Concrete, Inc.	GSI001152	Stormwater Industrial Activities - GP	Aiudi Concrete, Inc	Norris Avenue	7
Old Saybrook	Oyster River Landing Condo. Assoc.	UI0000021	Groundwater Discharge	Oyster River Condo Association	25 Sunset Rd	17
Old Saybrook	Max's Place LLC	UI0000445	Groundwater Discharge	Max's Place	NE Corner of Boston Post Road and Spence Plain Road	24
Old Saybrook	Town of Old Saybrook	UI0000430	Groundwater Discharge	Old Saybrook High School	1111 Boston Post Rd	23
Westbrook	Tanger Outlet Center	UI0000290	Groundwater Discharge	Tanger Outlet Center Westbrook	314 Flat Rock Pl	22
Old Saybrook	R. R. Donnelley & Sons Company	UI0000146	Groundwater Discharge	R. R. Donnelley & Sons Company	50 School House Rd	21
Westbrook	Town of Westbrook	GSM000054	Municipal Stormwater MS4	Town of Westbrook	MS4 General Permit	Entire town

As shown in Table 6, there are water quality data available from some of these discharges. Fecal coliform data cannot be compared to the WQS as there is no single sample shellfish standard for fecal coliform, however, no more than 10% of the samples can exceed 31 cfu/100 mL.

Table 6: Fecal coliform (colonies/100mL) data reported for Underground Injection permits in Westbrook. The results cannot be directly compared to the water quality standard as there is no single sample shellfish standard for fecal coliform.

Client	Site Name	Sample Dates	Permit Number	Sample Location	N=	Min	Max
Town of Westbrook	Westbrook High School	2008-2012	UI0000291	MW1	6	<10	<10
				MW2	7	<10	<10
				MW3	6	<10	<10
DGG Properties	Water's Edge Inn & Resort	2013-2014	UI0000087	Hotel Effluent	100	0	29
				Laundry Effluent	100	0	3
Coroc Holdings	Tanger Outlet Center	2014	UI0000290	Effluent	33	0	<1
Lee Company	Lee Company	2012-2014	UI0000089	MW-5	8	<10	180
				MW-6	8	<10	<10
				MW-7A	2	<10	<10
				MW-43	5	<10	<10
				MW-47A	1	<10	<10

Municipal Stormwater Permitted Sources

Per the EPA Phase II Stormwater rule all municipal storm sewer systems (MS4s) operators located within US Census Bureau Urbanized Areas (UAs) must be covered under MS4 permits regulated by the appropriate State agency. The Phase II Stormwater Rule also required coverage of state and federal institutions that it called “non-traditional” MS4s. State and federal prisons, colleges, hospitals and military facilities are covered by the general permit as non-traditional MS4s. There are 121 municipalities and 12 institutions currently regulated by CT DEEP’s General Permit for the Discharge of Stormwater from Small Municipal Storm Sewer Systems, effective January 1, 2017 (MS4 general permit). These municipalities and institutions are considered small MS4s as defined by EPA. Stormwater discharges from CT’s only medium MS4, Stamford, as defined by EPA, are regulated by an individual permit.

The US Census Bureau defines a UA as a densely settled area that exceeds a population of 50,000 people and has a population density of at least 1,000 people per square mile. The UA will also include adjacent block groups and blocks with at least 500 people per square mile. A UA consists of all or part of one or more incorporated places and/or census designated places, and may include additional territory outside of any place. (67 FR 11663) Maps of UAs are published after each decennial census, the most recent maps

reflect the results of the 2010 census. The current MS4 general permit requires implementation of the six minimum control measures throughout the municipality with some additional or alternate measures within the UA portion of the MS4. These six minimum measures are explained later in this document.

The impaired segments of the Westbrook Estuary are located within the Town of Westbrook. Westbrook has designated urban areas, as defined by the U.S. Census Bureau and is required to comply with the MS4 General permit (Figure 5). This general permit is applicable to municipalities that are identified in Appendix A of the MS4 permit that contain designated urban areas and discharge stormwater via a separate storm sewer system to surface waters of the State. The permit requires municipalities to develop a Stormwater Management Plan (SMP) to reduce the discharge of pollutants as well as protect water quality. The MS4 permit is discussed further in the core TMDL document and additional information regarding stormwater management and the MS4 permit can be obtained on CTDEEP's website (www.ct.gov/deep/stormwater).

There are six MS4 outfalls that have been sampled for *E. coli* bacteria in the watershed in Westbrook, discharging directly to the shoreline of LIS or indirectly through the Patchogue River (Table 7). Although the results cannot be compared to the water quality standard, as *E. coli* is the wrong indicator species for shellfish use, high counts were detected at all six of the outfalls in Westbrook.

Figure 5: MS4 areas near the Westbrook Estuary

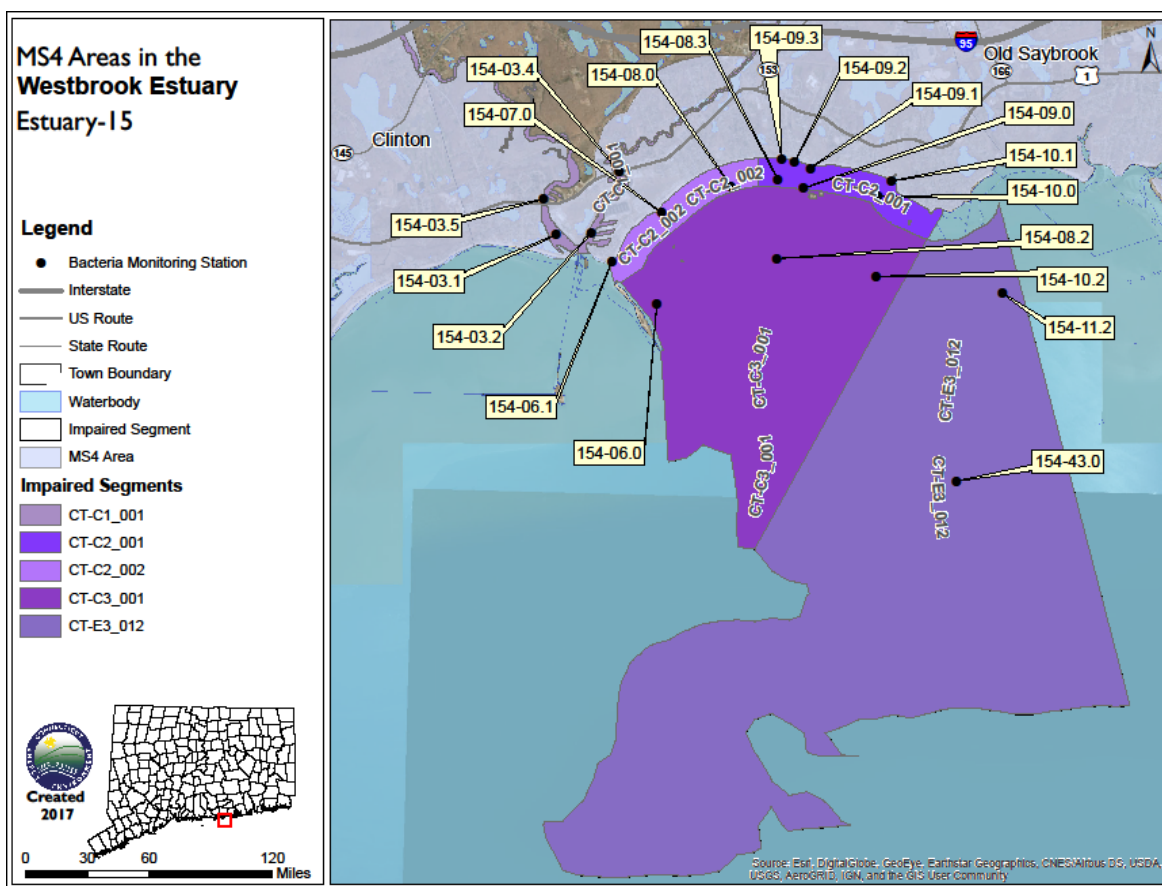


Table 7: List of MS4 sample locations and *E. coli* (colonies/100 mL) results in or near the Westbrook Estuary. The results cannot be directly compared to the water quality standard as there as *E. coli* is the wrong indicator species for shellfish use.

Town	Location	MS4 Type	Receiving Water	Sample Date	Result
Westbrook	C1	Commercial	LIS	10/19/07	2,420
Westbrook	C1	Commercial	LIS	11/06/07	411
Westbrook	C1	Commercial	LIS	04/03/09	326
Westbrook	C1	Commercial	LIS	04/06/09	290
Westbrook	C1	Commercial	LIS	07/21/09	1,553
Westbrook	C1: Linden Ave South	Commercial	LIS	04/15/14	>200
Westbrook	C1 Upstream Catch basin on Linden Ave South	Commercial	LIS	09/10/15	1,400
Westbrook	C2	Commercial	Patchogue River Basin	10/19/07	>816
Westbrook	C2	Commercial	Patchogue River Basin	11/06/07	187
Westbrook	C2	Commercial	Patchogue River Basin	04/03/09	16
Westbrook	C2	Commercial	Patchogue River Basin	04/06/09	2
Westbrook	C2	Commercial	Patchogue River Basin	07/21/09	1,986
Westbrook	C2: 1 Flat Rock Place	Commercial	Patchogue River Basin	04/15/14	>200
Westbrook	C2 Upstream catch basin near 1 Flat Rock Place	Commercial	Patchogue River Basin	09/10/15	300
Westbrook	I1	Industrial		10/19/07	1,300
Westbrook	I1	Industrial		11/06/07	159

Town	Location	MS4 Type	Receiving Water	Sample Date	Result
Westbrook	I1	Industrial		04/03/09	8
Westbrook	I1	Industrial		04/06/09	1
Westbrook	I1	Industrial		07/21/09	687
Westbrook	I1 Culvert on Lee Co property near 2 Pettipaug Rd	Industrial		09/10/15	700
Westbrook	I2	Industrial	Patchogue River Basin	10/19/07	>2,420
Westbrook	I2	Industrial	Patchogue River Basin	11/06/07	140
Westbrook	I2	Industrial	Patchogue River Basin	04/03/09	10.9
Westbrook	I2	Industrial	Patchogue River Basin	04/06/09	10.8
Westbrook	I2	Industrial	Patchogue River Basin	07/21/09	>2,420
Westbrook	I2: 2 Pettipaug Road	Industrial	Patchogue River Basin	04/15/14	>200
Westbrook	I2: 35 Wesley Ave	Industrial	Patchogue River Basin	04/15/14	>200
Westbrook	I2 Upstream catch basin near 36 Wesley Ave	Industrial	Patchogue River Basin	09/10/15	1200
Westbrook	R1	Residential	LIS	10/19/07	>2,420
Westbrook	R1	Residential	LIS	11/06/07	980
Westbrook	R1	Residential	LIS	04/03/09	1
Westbrook	R1	Residential	LIS	04/06/09	2
Westbrook	R1	Residential	LIS	07/21/09	2,420
Westbrook	R1: 249 Seaside Ave	Residential	LIS	04/15/14	>200

Town	Location	MS4 Type	Receiving Water	Sample Date	Result
Westbrook	R1 Outfall near 249 Seaside Ave	Residential	LIS	09/10/15	>20,000
Westbrook	R2	Residential	Patchogue River Basin	10/19/07	1,733
Westbrook	R2	Residential	Patchogue River Basin	11/06/07	1,300
Westbrook	R2	Residential	Patchogue River Basin	04/03/09	2
Westbrook	R2	Residential	Patchogue River Basin	04/06/09	2
Westbrook	R2	Residential	Patchogue River Basin	07/21/09	>2,420
Westbrook	R2: 26 Beech Tree Lane	Residential	Patchogue River Basin	04/15/14	>200
Westbrook	R2 Upstream Catch Basin near 26 Beech Tree Lane	Residential	Patchogue River Basin	09/10/15	90

Publicly Owned Treatment Works

According to our records, there are no Water Pollution Control Facilities (WPCFs) in Westbrook, public or private.

Non-point Sources

Non-point source (NPS) pollution comes from many diffuse sources and is more difficult to identify and control. NPS pollution is often associated with certain land-use practices. Examples of NPS that can contribute bacteria to surface waters include stormwater runoff, illicit discharges, insufficient septic systems, pet and wildlife waste, agriculture, and contact recreation (swimming or wading). With the waters that are tidally influenced, bacterial sources that appear to be downstream of the impaired segment may be also affecting the water quality in upstream segments. Potential sources of NPS to the impaired segments in the Westbrook Estuary are described below.

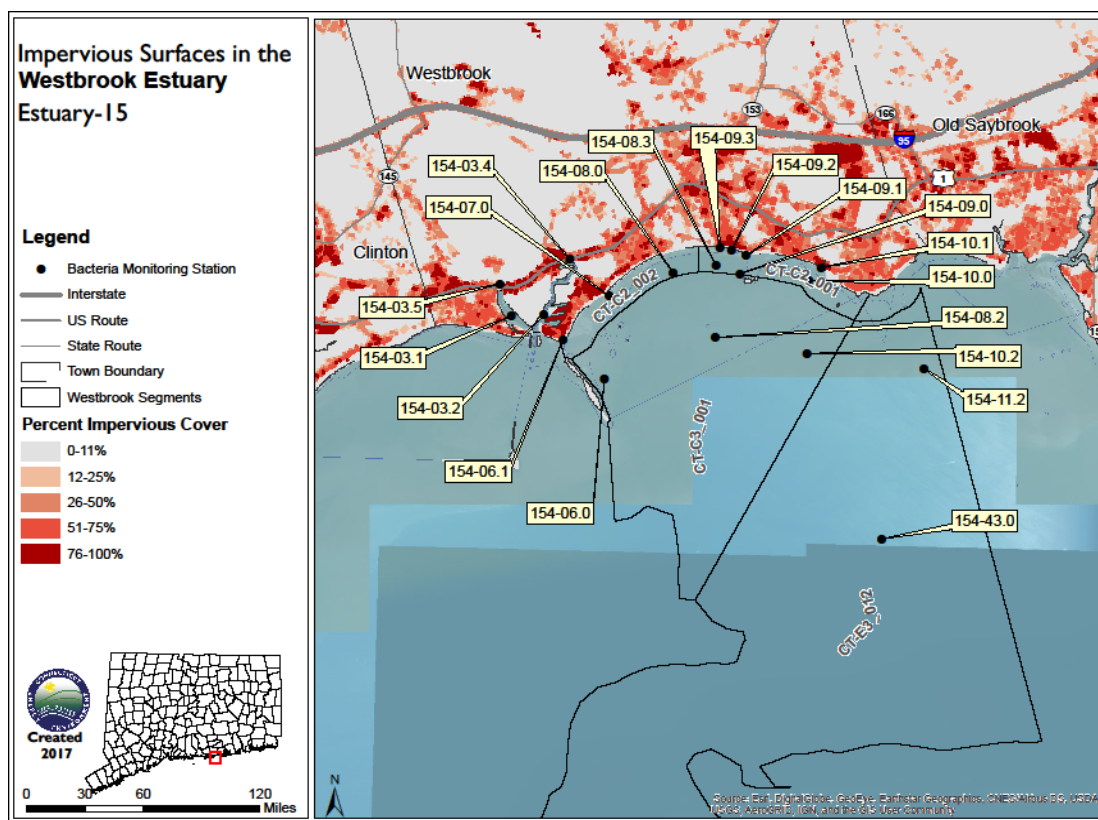
Stormwater Runoff from Developed Areas

Impervious cover (IC) refers to hard surfaces across the landscape such as roads, sidewalks, parking lots and roofs. IC forces rain to runoff the land, carrying pollutants quickly and directly to surface waters instead of soaking into the ground. Studies have shown a link between the amount of impervious area in a watershed and water quality conditions (CWP, 2003). In one study, researchers correlated the amount

of fecal coliform to the percentage of land with impervious cover in a watershed (Mallin *et al.*, 2000). While all levels of IC can contribute stormwater to streams, it is important to note that land with greater than 12% IC is likely to be contributing enough stormwater to streams to have a negative impact on water quality (CWP, 2003). Towns should aim to make stormwater improvements in areas with IC greater than 12% in an effort to reduce the amount of stormwater pollution reaching surface waters which will protect and improve water quality.

In Westbrook, most areas with the highest percentage of impervious cover are found south of Route 95, bordering the estuary (Figure 6). 15% of the Town of Westbrook has >12% impervious cover. For more information please refer to the town factsheets on our web site, using the map or pulldown list (www.ct.gov/deep/cwp/view.asp?A=2719&Q=567336). Stations on Segment 1 (CT-C1_001) and Segment 2 (CT-C2_001), exceeded the WQS for fecal coliform during wet-weather, which indicates that stormwater runoff is likely contributing bacteria to the estuary.

Figure 6: Impervious cover (%) for Westbrook



Illicit Discharges and Insufficient Septic Systems

There is no WPCF in Westbrook; all properties are served by subsurface sewage disposal systems. Properly managed septic systems and leach fields have the ability to effectively remove bacteria from waste. If systems are not maintained, waste will not be adequately treated and may result in bacteria reaching nearby surface and ground water. In Connecticut, local health directors or health districts are responsible for investigating and issuing orders to abate insufficient or failing septic systems within their jurisdiction.

Wildlife and Domestic Animal Waste

Wildlife, including waterfowl, and domestic animals within the municipality of Westbrook, including those present in the estuary, represent another potential source of bacteria to the impaired waterbodies. Elevated bacteria levels due solely to a natural population of wildlife are not subject to the WQS. However, any exacerbation of wildlife population sizes or residency times influenced by human activities is subject to the CT WQS and TMDL provisions. With the construction of roads and drainage systems, wastes from these waterfowl may no longer be retained on the landscape, but instead may be conveyed via stormwater to the nearest surface waterbody. As such, physical land alterations can exacerbate the impact of these natural sources on water quality (USEPA, 2001).

Geese and other waterfowl are known to congregate in open areas, including recreational fields, agricultural crop fields, and golf courses. There is a 110 acre golf course located on the border of Westbrook in Clinton that is part of the watershed of the Menunketesuck River. In addition to creating a nuisance, large numbers of geese can create unsanitary conditions on the grassed areas and cause water quality problems due to bacterial contamination associated with their droppings. Large populations of geese can also lead to habitat destruction as a result of overgrazing on wetland and riparian plants.

Part of the McKinney Wildlife Refuge, The Salt Meadow Unit, is located in Westbrook. This area has abundant wildlife, especially during the spring and summer months. The Salt Meadow Unit is 316 acres of salt marsh, forest, grassland, and shrubland located on the Atlantic Flyway. In addition to resident species of waterfowl and land animals, this diverse landscape is visited by 280 species of migrating neotropical birds during the spring and fall migrations as well as some species overwintering here.

([www.fws.gov/refuge/Stewart B McKinney/](http://www.fws.gov/refuge/Stewart_B_McKinney/))

Portions of Westbrook, feature heavily developed commercial areas and residential properties. As such, waste from domestic animals, such as dogs, may also be contributing to bacteria concentrations in some of the impaired segments in the Westbrook Estuary. Westbrook has a dog ordinance (www.westbrookct.us/Docs/dogordinance52913.pdf) requiring owners to clean up after their dogs when they are on town property. There is a fine for owners that do not comply “The owner of any dog who leaves waste on any park, athletic field, playground or beach at any time shall clean up after said dog, and failure to do so shall be punishable by a fine in accordance with the provisions of subparagraph (f) of this ordinance.”

Marinas

As noted previously, multiple marinas are located within the Westbrook Estuary (Figure 4 and Table 5). Marinas are located at the water's edge, and if no measures are taken to reduce pollutants, including buffering, pollutants can be transported via runoff from parking lots and hull maintenance areas directly into the marina basin. Common pollutants from marinas include bacteria and nutrients from stormwater runoff, solid and liquid materials used in boat maintenance and cleaning, fuel and oil, sewage from public restrooms and boat pump-outs, fish waste, and turbidity from boating activities. There are two marinas that offer pump-out services in Westbrook, Harry's Marine and Brewer Pilot's Point. The CT DEEP has information on regional pump-out boats and facilities at its website, www.ct.gov/deep/cwp/view.asp?a=2705&q=323708&depNav_GID=1711. Most services are free and eliminate the possibility of vessels dumping raw wastes into Long Island Sound, which is prohibited by CT Water Quality Standards Number 24, “the discharge of sewage from any vessel to any water is prohibited.”

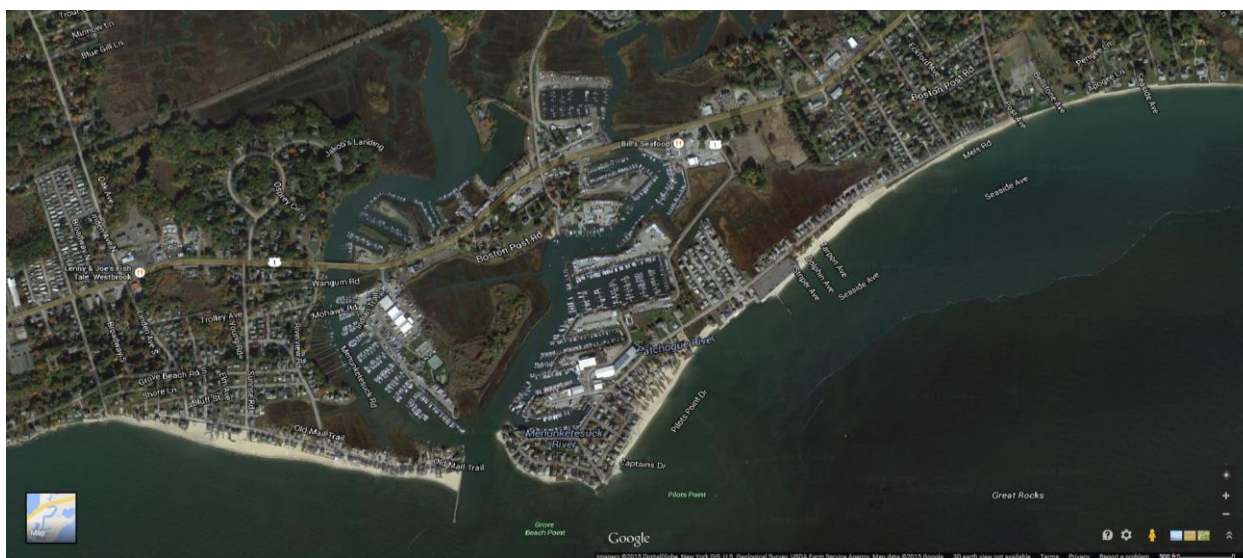
The Westbrook Harbor Management Plan (Westbrook Harbor Management Commission, 2014)

recommends that all marinas in town participate in the Clean Marina Program. Our CT DEEP records

Westbrook Estuary TMDL

indicate that 2 marinas qualified for this program, Harry's Marine Repair and Ritt's Marine Center. The Clean Marina Program is not currently accepting new pledges or conducting recertifications, however, educational materials are provided on the CT DEEP website (www.ct.gov/deep/cleanmarina). This program is described in more detail later in this document.

All Connecticut coastal waters are designated "No Discharge Areas" (NDAs) prohibiting the discharge of sewage, treated or untreated. Eliminating the release of all sewage from boats, will result in further reductions of human fecal waste discharge and, therefore, reductions in nutrient loading and potential human exposure to bacterial and viral pathogens in swimming areas, shellfish beds and other environmentally sensitive aquatic habitats. CT DEEP records show, two Westbrook marinas have pump out services and one has a pump-out boat. For more information please see our web site (www.ct.gov/deep/cwp/view.asp?a=2705&q=323816&deepNav_GID=1635). According to the Westbrook Harbor Management Plan, the Town is home to over 2000 vessels docked or moored within Westbrook. That number does not include boats docked at private residences. The area around the mouths of the Menunketesuck and Patchogue Rivers (Segment 1 CT-C1_001) is especially congested with boats and marinas.



Picture above from Google Maps showing the multiple dock areas found near the mouths of the Menunketesuck and Patchogue Rivers.

Recreation

People coming in direct contact with surface water presents another potential source of bacterial contamination. Microbial source tracking (MST) surveys conducted in New Hampshire have shown humans to be a source of bacterial contamination at beaches (Jones, 2008). Since there are two designated public swimming areas along the shoreline, Middle Beach and West Beach, and multiple private beach areas in the watershed, it is probable that some bacterial contamination can be attributed to human activities in the Westbrook Estuary.

Additional Sources

There may be other sources not listed here or identified in Figure 4 that contribute to the observed water quality impairments in the Westbrook Estuary. Further monitoring and investigation will confirm the listed sources and discover additional ones. More detailed evaluation of potential sources is expected to become available as activities are conducted to implement this TMDL.

Current Management Activities

The National Shellfish Sanitation Program (NSSP) has multiple requirements for the protection and evaluation of shellfish growing areas. More information about this program is provided below and available online: www.fda.gov/food/guidanceregulation/federalstatefoodprograms/ucm2006754.htm

The NSSP requires the completion of a sanitary survey to determine acceptable and unacceptable growing areas, and to accurately classify a growing area as Approved, Conditionally Approved, Restricted, Conditionally Restricted, or Prohibited. A sanitary survey is an in-depth evaluation of all environmental factors impacting water quality in a shellfish growing area. Environmental factors include both actual and potential pollutant sources, whether natural or man-made, along with meteorological and hydrographic characteristics of the growing area. The principal components of a sanitary survey are: (1) identification and evaluation of pollutant sources, (2) evaluation of meteorological factors, (3) evaluation of hydrographic factors affecting the distribution of pollutants, and (4) assessment of water quality.

The sanitary survey includes data and results from the following:

1. Shoreline survey;
2. Survey of the bacteriological quality of the water;
3. Evaluation of meteorological, hydrodynamic, and geographic characteristics of the growing area;
4. Analysis of shoreline survey, bacteriological water quality, and meteorological, hydrodynamic, and geographic characteristics; and
5. Determination of the appropriate growing area classification

Maintaining updated sanitary survey records consists primarily of routinely evaluating major pollutant sources, collecting water quality data from sampling stations under the selected NSSP water quality monitoring strategy, and analyzing the data to ensure that the classification continues to represent current sanitary conditions in the growing area. The entire sanitary survey process must be repeated every 12 years. In the interim, the sanitary quality of each growing area must be reviewed as often as necessary to ensure appropriate classification. Certain sanitary survey components are required by the Model Ordinance to be updated annually and triennially.

The growing area classification and supporting data from the sanitary survey shall be reviewed at least every three years. As required by the NSSP, this triennial re-evaluation shall include:

1. A review of water quality sampling results;
2. Documentation of any new pollutant sources and evaluation of their impact on the growing area;
3. Re-evaluation of all pollutant sources, including sources previously identified in the sanitary survey, as necessary to fully evaluate any changes in the sanitary conditions of the growing area. Re-evaluation may or may not include a site visit;
4. A comprehensive report analyzing the sanitary survey data and determining whether the existing growing area classification is accurate or requires revision; and

5. Reclassification of the growing area if re-evaluation determines that conditions for classification have changed based on data collected during the triennial review

NSSP also requires that the sanitary survey be updated annually to reflect changes in conditions in the growing area. The annual re-evaluation shall include:

1. Field observation of pollutant sources during drive-through surveys, sample collections, or other information sources;
2. Addition and review of current year's water quality sampling results to a database collected in accordance with the bacteriological standards and sample collection required;
3. Review of available inspection reports and effluent samples collected from pollutant sources;
4. Review of available performance standards for various types of discharges impacting the growing area; and
5. A brief report documenting annual re-evaluation findings.

The most recent annual evaluation for the Shellfish Growing Waters in the Town of Westbrook was published in 2005 (DA/BA, 2005). According to this report, based on the available data and information Westbrook shellfishing waters are properly classified and no changes are warranted at this time.

Other efforts have been taken by Westbrook to reduce bacteria to its surface waters. As indicated previously, Westbrook is regulated under the MS4 program. The MS4 General Permit is required for any municipality with urbanized areas that initiates, creates, originates or maintains any discharge of stormwater from a storm sewer system to waters of the State. The MS4 general permit requires towns to design a Stormwater Management Plan (SMP) that reduces the discharge of stormwater pollutants to improve water quality. The plan must address the following six minimum measures:

1. Public Education and Outreach.
2. Public Involvement/Participation.
3. Illicit discharge detection and elimination.
4. Construction site stormwater runoff control.
5. Post-construction stormwater management in the new development and redevelopment.
6. Pollution prevention/good housekeeping for municipal operations.

Each municipality is also required to submit an annual update outlining steps taken to meet the six minimum measures. The most recent updates that address bacterial contamination in the watershed are summarized in Table 8.

Table 8: Summary of MS4 requirement updates related to the reduction of Stormwater contamination from Westbrook, CT (Permit # GSM000054)

Minimum Measure	Westbrook Annual Report (2016)
Public Outreach and Education	<ol style="list-style-type: none"> 1) Middle school students conduct surveys on Cold Spring Creek 2) GIS information is available on the Town Website 3) The Town of Westbrook continues to display and make available for the public to read and take the following brochures:: <ul style="list-style-type: none"> • EPA brochure "After the Storm" • EPA brochure "Rivers Beneath Our Feet" • "The Importance of Stream Buffers" developed by Rivers Alliance of Connecticut • A pet waste brochure

Minimum Measure	Westbrook Annual Report (2016)
Public Involvement and Participation	Annual Cleanup day and hazardous waste program
Illicit Discharge Detection and Elimination	1) Mapped outfalls greater than 15" town-wide and greater than 12" in the urbanized areas. 2) Illicit Discharge Ordinance was finalized in 2017 3) Identifying and addressing failing septic systems and working on sewer upgrades Town-wide.
Construction Site Stormwater Runoff Control	Regulations require soil erosion and sediment control plans for projects >1/2 acre, these plans are certified for approval by the Zoning Commission, and they do inspections to ensure compliance.
Post Construction Stormwater management	1) On-going development and implementation of post-construction ordinance & regulations 2) Development and implementation of post construction BMP strategy.
Pollution Prevention and Good Housekeeping	The following have been implemented and are on-going: <ul style="list-style-type: none"> • Training program for Municipal employees related to stormwater management. • Streets are swept annually after snowmelt, streets in beach areas are swept twice per year • Evaluations of areas (such as beaches) for possible sweeping more than once a year. • Annual clean-up of approximately 1,000 catch basins. • Town has a dedicated vehicle washing bay with a collection system

RECOMMENDED NEXT STEPS

Westbrook has developed and implemented programs to protect water quality from bacterial contamination. Future mitigation activities are necessary to ensure the long-term protection of Segments 1 – 5 in the Westbrook Estuary and have been prioritized below.

1) Continue monitoring of permitted sources.

There are at least 20 permitted sources in the Westbrook Estuary. Some of these facilities should be monitoring for bacteria. Further monitoring will provide information essential to better locate, understand, and reduce pollution sources. If any current monitoring is not done with appropriate bacterial indicator based on the receiving water, then a recommended change during the next permit reissuance is to include the appropriate indicator species. If facility monitoring indicates elevated bacteria, then implementation of permit is required, and any voluntary measures to identify and reduce sources of bacterial contamination at the facility are also recommended. Regular monitoring should be established for all permitted sources to ensure compliance with permit requirements and to determine if current requirements are adequate or if additional measures are necessary for water quality protection.

The General Permit for the Discharge of Stormwater from Small Municipal Separate Storm Sewer Systems (MS4), effective July 1, 2017 requires some additional control measures for outfalls that discharge into impaired waters with or without a TMDL. In addition, waterbodies that are subject to an approved TMDL should be given priority when investigating illicit discharges. Section 6(k) of the MS4 General Permit requires a municipality that discharges stormwater into impaired waters with or without a TMDL to perform monitoring based on the pollutant of concern. The sample shall be analyzed for the pollutants identified as the cause of the impairment. If phosphorus, nitrogen, bacteria or mercury are the stormwater pollutants of concern, control measures and outfall monitoring is required to investigate and target potential sources of these pollutants. Additional BMPs may be required to address areas with sample results showing elevated levels of the pollutant(s) of concern. In the case of bacteria related impairments municipal BMPs could include: implementation or improvement to existing nuisance wildlife programs, septic system monitoring programs, any additional measures that can be added to the required illicit discharge detection and elimination (IDDE) programs, and increased street sweeping above basic permit requirements. Any non-MS4 municipalities can implement these same types of initiatives in effort to reduce bacteria source loading to impaired waterways. For all other impairments Section 6(i)(1)C requires monitoring for turbidity at the outfall and immediately upstream of the outfall. Implementation of control measures is required if the turbidity at the outfall is 5 or more NTUs greater than the turbidity upstream. The permittee shall implement BMPs as necessary to achieve the Waste Load Allocation, Load Allocation or Water Quality Targets specified within the TMDL. Please see the current MS4 General permit for information www.ct.gov/deep/municipalstormwater.

Any facilities regulated by CT DEEP that discharge non-MS4 regulated stormwater should update their Pollution Prevention Plan to reflect BMPs that can reduce bacteria loading to the receiving waterway. These BMPs could include nuisance wildlife control programs and any installations that increase surface infiltration to reduce overall stormwater volumes.

Tables 9 and 10 detail the appropriate bacteria criteria for use as waste load allocations established by this TMDL for use as water quality targets by permittees as permits are renewed and updated, within the Westbrook Estuary.

Table 9. Bacteria (Enterococci) TMDLs, WLAs, and LAs for Recreational Uses.

		Instantaneous Enterococcus (#/100mL)				Geometric Mean Enterococcus (#/100mL)	
Class	Bacteria Source	WLA ⁶		LA ⁶		WLA ⁶	LA ⁶
	Recreational Use	1	2	1	3	All	All
SA ⁵	Illicit sewer connection	0	0			0	
	Leaking sewer lines	0	0			0	
	Stormwater (MS4s)	104 ⁷	500 ⁷			35 ⁷	
	Stormwater (non-MS4)			104 ⁷	500 ⁷		35 ⁷
	Wildlife direct discharge			104 ⁷	500 ⁷		35 ⁷
	Human or domestic animal direct discharge ³			104	500		35
SB ⁵	Non-Stormwater NPDES	104	500			35	
	CSOs	104	500			35	
	SSOs	0	0			0	
	OBDs ⁴	0	0			0	
	Illicit sewer connection	0	0			0	
	Leaking sewer lines	0	0			0	
	Stormwater (MS4s)	104 ⁷	500 ⁷			35 ⁷	
	Stormwater (non-MS4)			104 ⁷	500 ⁷		35 ⁷
	Wildlife direct discharge			104 ⁷	500 ⁷		35 ⁷
	Human or domestic animal direct discharge ³			104	500		35

- (1) **Designated Swimming.** Procedures for monitoring and closure of bathing areas by State and Local Health Authorities are specified in: Guidelines for Monitoring Bathing Waters and Closure Protocol, adopted jointly by the Department of Environmental Protections and the Department of Public Health. May 1989. Revised April 2003 and updated December 2008.
- (2) **Non-Designated Swimming.** Includes areas otherwise suitable for swimming but which have not been designated by State or Local authorities as bathing areas, waters which support tubing, water skiing, or other recreational activities where full body contact is likely.
- (3) **All Other Recreational Uses.**
- (4) Criteria for the protection of recreational uses in Class B waters do not apply when disinfection of sewage treatment plant effluents is not required consistent with Standard 23. (Class B surface waters located north of Interstate Highway I-95 and downstream of a sewage treatment plant providing seasonal disinfection May 1 through October 1, as authorized by the Commissioner.)
- (5) Human direct discharge = swimmers
- (6) Unless otherwise required by statute or regulation, compliance with this TMDL will be based on ambient concentrations and not end-of-pipe bacteria concentrations
- (7) Replace numeric value with "natural levels" if only source is naturally occurring wildlife. Natural is defined as the biological, chemical and physical conditions and communities that occur within the environment which are unaffected or minimally affected by human influences (CT DEEP 2011). Sections 2.2.2 and 6.2.7 of this Core Document deal with BMPs and delineating type of wildlife inputs.

Table 10: Bacteria (Fecal Coliform) TMDLs, WLAs, and LAs for Shellfish Harvesting Areas.

Class	Bacteria Source ¹	Geometric Mean Fecal coliform (#/100mL) ⁴		90% less than Statistical measure Fecal Coliform (#/100mL) ⁴	
		WLA ⁵	LA ⁵	WLA ⁵	LA ⁵
SA Direct Consumption	CSOs	14		31	
	SSOs	0		0	
	OBDs ³	0		0	
	Illicit sewer connection	0		0	
	Leaking sewer lines	0		0	
	Stormwater (MS4s)	14 ⁶		31 ⁶	
	Stormwater (non-MS4)		14 ⁶		31 ⁶
	Wildlife direct discharge		14 ⁶		31 ⁶
	Human or domestic animal direct discharge ²		14		31
SB Indirect Consumption	Non-Stormwater NPDES	88		260	
	CSOs	88		260	
	SSOs	0		0	
	OBDs ³	0		0	
	Illicit sewer connection	0		0	
	Leaking sewer lines	0		0	
	Stormwater (MS4s)	88 ⁶		260 ⁶	
	Stormwater (non-MS4)		88 ⁶		260 ⁶
	Wildlife direct discharge		88 ⁶		260 ⁶
	Human or domestic animal direct discharge ²		88		260

(1) Criteria are based on utilizing the mTec method as specified in the U.S. Food and Drug Administration National Shellfish Sanitation Program-Model Ordinance (NSSP-MO) document *Guide for the Control of Molluscan Shellfish 2007*.

(2) Human direct discharge = swimmers

(3) All coastal and inland waters in Connecticut are designated as No Discharge Areas for Overboard Discharges (OBDs) from marine vessels with Marine Sanitation Devices.

(4) Adverse Condition Allocations apply to areas affected by Point Sources. Adverse Condition or Random Sampling Allocations apply to areas affected by Nonpoint Sources. Adverse condition is defined as "... a State or situation caused by meteorological, hydrological or seasonal events or point source discharges that has historically resulted in elevated [bacteria] levels in the particular growing area." USFDA 2005

(5) Unless otherwise required by statute or regulation, compliance with this TMDL will be based on ambient concentrations and not end-of-pipe bacteria concentrations

(6) Replace numeric value with "natural levels" if only source is naturally occurring wildlife. Natural is defined as the biological, chemical and physical conditions and communities that occur within the environment which are unaffected or minimally affected by human influences (CT DEEP 2011). Sections 2.2.2 and 6.2.7 of this Core Document deal with BMPs and delineating type of wildlife inputs.

2) Identify areas in Westbrook to implement Best Management Practices (BMPs) to control stormwater runoff.

As noted previously, much of the coastal land of the Westbrook Estuary has impervious cover greater than 12% and some of the impaired segments (CT-C2_001 and CT-C2_002) are surrounded by >26% impervious cover. The Town has urban areas regulated under the MS4 program. As such, stormwater runoff is likely contributing bacteria to the Westbrook Estuary. To identify areas that are contributing bacteria to the impaired segments, municipalities should conduct wet-weather sampling at stormwater outfalls that discharge directly to the impaired segments in Westbrook Estuary. To treat stormwater runoff, the towns should identify areas along the developed sections of the impaired segments to install BMPs designed to encourage stormwater to infiltrate the ground before entering the waterbodies. These BMPs would disconnect impervious areas and reduce pollutant loads to the estuary. More detailed information and BMP recommendations can be found in the core TMDL document established in September 2012 and available at www.ct.gov/deep/lib/deep/water/tmdl/statewidebacteria/ct_bacteria_coredoc_tmdl.pdf.

3) Inspect septic systems.

There are no public sewers in Westbrook. The entire town relies on subsurface sewage disposal systems. Westbrook has established a Water Pollution Control Commission to ensure that existing septic systems are properly operated and maintained (www.westbrookct.us/water-pollution-control-commission.php). Inspections help encourage proper maintenance and identify failed and sub-standard systems. Municipalities can also develop programs to assist citizens with the replacement and repair of older and failing systems. Policies that govern the eventual replacement of the sub-standard systems within a reasonable timeframe are included in this ordinance. There are also sanitation requirements for marinas.

4) Evaluate municipal education and outreach programs regarding animal waste.

Any education and outreach program should highlight the importance of not feeding waterfowl and wildlife and managing waste from horses, dogs, and other pets. Municipalities and residents can take measures to minimize waterfowl-related impacts by allowing tall, coarse vegetation to grow in riparian areas of impaired segments frequented by waterfowl. Waterfowl, especially grazers like geese, prefer easy access to water. Maintaining an uncut vegetated buffer along the shore will make the habitat less desirable to geese and encourage migration. In addition, any educational program should emphasize that feeding waterfowl, such as ducks, geese, and swans, may contribute to water quality impairments in the Westbrook Estuary and can harm human health and the environment. Animal wastes should be disposed of away from any waterbody or storm drain system. BMPs effective at reducing the impact of animal waste on water quality include installing signage, providing pet waste receptacles in high-use areas, enacting ordinances requiring the clean-up of pet waste, and targeting educational and outreach programs in problem areas. The Town of Westbrook does have an ordinance in place that will fine pet owners that do not clean up after their pets on town property.

5) Improve education and outreach programs regarding boats and marinas.

Marinas must comply with permit requirements that limit bacteria contribution to the Westbrook Estuary. Other programs, such as Connecticut's Clean Marina Program, may also be adopted by all marinas in the estuary to reduce bacteria contribution from non-point source pollution from marinas (www.ct.gov/deep/cleanmarina). The Clean Marina Program is a voluntary program that encourages inland and coastal marina operators to minimize pollution, and recognizes Connecticut marinas, boatyards, and yacht clubs that go above and beyond regulatory compliance as "Certified Clean Marinas." While the Clean Marina Program is not currently accepting new pledges or conducting recertifications, educational materials are provided on the CT DEEP website. Marinas are encouraged to review and apply these recommendations at their facility, as appropriate, to minimize pollution from their site. All previously certified marinas receive

a weatherproof Clean Marina Flag to fly at their facility and authorization to use the Clean Marina Program logo on company publications. CT DEEP recognized certified Clean Marinas through press releases, on its web page, and at public events. As a companion to the Clean Marina Program, the Clean Boater Program (www.ct.gov/deep/cwp/view.asp?a=2705&q=323526) encourages boaters to use clean boating techniques when operating and maintaining their boats.

BACTERIA DATA AND PERCENT REDUCTIONS TO MEET THE TMDL

Rainfall data listed in the tables below were reported at Tweed New Haven Airport. When rainfall data was missing from Tweed, rainfall data from Groton was used as reported by the National Oceanic and Atmospheric Administration (NOAA). Shaded cells indicate an exceedance of water quality criteria.

Table 11: Segment 1: LIS CB Inner - Patchogue and Menunketesuck Rivers Bacteria Data**Waterbody ID:** CT-C1_001**Characteristics:** Saltwater, Class SA**Impairment:** Shellfishing**Water Quality Criteria for Fecal coliform:**

Geometric Mean: 14 colonies/100 ml

90% of Samples Less Than: 31 colonies/100 ml

Percent reduction to meet:

Geometric Mean: 94.6%

90% of Samples Less Than: 90%

Data: 2000 – 2011 from DA/BA sampling efforts, 2014 TMDL cycle

Single sample fecal coliform data (colonies/100mL) for all monitoring stations on segment: LIS CB Inner – Patchogue and Menunketesuck Rivers (CT-C1_001) with annual geometric means and reduction goals for samples.

Station #	Station Name	Date	Results	Wet/Dry	Geomean	90% Reduction
154-03.1		2/15/2000	29	Wet	86.5	40
154-03.1		6/7/2000	258	Wet		
154-03.1		8/13/2001	258	Wet	258	90
154-03.1		6/17/2002	248	Dry	88.1	90
154-03.1		6/18/2002	54	Dry		
154-03.1		10/28/2002	51	Dry		
154-03.1		7/12/2005	30	Dry	45.2	40
154-03.1		7/13/2005	68	Dry		
154-03.1		4/25/2006	9	Wet	16.2	n/a
154-03.1		9/18/2006	29	Dry		

Station #	Station Name	Date	Results	Wet/Dry	Geomean	90% Reduction
154-03.1		7/29/2008	84	Dry	22.4	40
154-03.1		7/30/2008	6	Dry		
154-03.2		2/15/2000	88	Wet	150.7	90
154-03.2		6/7/2000	258	Wet		
154-03.2		8/13/2001	248	Wet	248	90
154-03.2		6/17/2002	139	Dry	72.6	90
154-03.2		6/18/2002	54	Dry		
154-03.2		10/28/2002	51	Dry		
154-03.2		7/12/2005	22	Dry	52.6	40
154-03.2		7/13/2005	126	Dry		
154-03.2		4/25/2006	21	Wet	20	n/a
154-03.2		9/18/2006	19	Dry		
154-03.2		7/29/2008	104	Dry	43.3	40
154-03.2		7/30/2008	18	Dry		
154-03.4		2/15/2000	88	Wet	36.1	40
154-03.4		3/21/2000	8.7	Dry		
154-03.4		3/22/2000	8.6	Dry		
154-03.4		6/12/2000	258	Wet		
154-03.4		2/20/2001	8.6	Dry	8.6	n/a
154-03.4		5/6/2002	70	Dry	59.7	90
154-03.4		10/28/2002	51	Dry		
154-03.4		11/24/2003	23	Dry	34.2	40
154-03.4		12/22/2003	51	Dry		
154-03.4		9/22/2005	48	Dry	43.8	90
154-03.4		12/27/2005	40	Dry		
154-03.4		12/4/2006	32	Dry	32	90

Station #	Station Name	Date	Results	Wet/Dry	Geomean	90% Reduction
154-03.4		10/18/2010	4	Dry	3.8	n/a
154-03.4		11/7/2010	9	Dry		
154-03.4		11/21/2010	1	Dry		
154-03.4		12/5/2010	6	Dry		
154-03.4		4/18/2011	61	Wet	23.4	40
154-03.4		4/26/2011	9	Dry		
154-03.5		11/24/2003	23	Dry	39.3	40
154-03.5		12/22/2003	67	Dry		
154-03.5		9/22/2005	171	Dry	96.1	90
154-03.5		12/27/2005	54	Dry		
154-03.5		12/4/2006	41	Dry	41	90
154-03.5		10/18/2010	5	Dry	7.2	n/a
154-03.5		11/7/2010	22	Dry		
154-03.5		11/21/2010	8	Dry		
154-03.5		12/5/2010	3	Dry		
154-03.5		4/18/2011	75	Wet	21.2	40
154-03.5		4/26/2011	6	Dry		
Shaded cells indicate an exceedance of water quality criteria						

Wet and dry weather geometric mean values for all monitoring stations on Segment 1: LIS CB Inner – Patchogue and Menunketesuck Rivers (CT-C1_001)

Station #	Station Name	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
154-03.1		2000-2008	4	8	51.57	64.56	46.09
154-03.2		2000-2011	4	8	63.7	104.28	52.17
154-03.4		2000-2011	3	15	20.6	111.47	14.7
154-03.5		2000-2011	1	10	22.34	75	19.8
Shaded cells indicate an exceedance of water quality criteria							

Table 12: Segment 2: LIS CB Shore – Westbrook Harbor (East) Bacteria Data**Waterbody ID:** CT-C2_001**Characteristics:** Saltwater, Class SA**Impairment:** Shellfishing**Water Quality Criteria for Fecal coliform:**

Geometric Mean: 14 colonies/100 ml

90% of Samples Less Than: 31 colonies/100 ml

Percent reduction to meet:

Geometric Mean: 84.05%

90% of Samples Less Than: 90%

Data: 2000 – 2011 from DA/BA sampling efforts, 2014 TMDL cycle**Single sample fecal coliform data (colonies/100mL) for all monitoring stations on segment 2: LIS CB Shore – Westbrook Harbor, Westbrook (CT-C2_001) with annual geometric means and reduction goals for samples.**

Station #	Station Name	Date	Results	Wet/Dry	Geomean	90% Reduction
154-08.3		6/7/2000	36	Wet	7.8	23
154-08.3		9/14/2000	3.6	Wet		
154-08.3		9/19/2000	3.6	Wet		
154-08.3		8/13/2001	51	Wet	11.7	23
154-08.3		8/16/2001	3.6	Dry		
154-08.3		8/21/2001	8.7	Wet		
154-08.3		6/17/2002	8.1	Dry	7.4	n/a
154-08.3		6/18/2002	5.8	Dry		
154-08.3		9/19/2002	8.6	Dry		
154-08.3		8/20/2003	3.6	Dry	3.6	n/a
154-08.3		7/12/2005	9	Dry	6	n/a
154-08.3		7/13/2005	4	Dry		
154-08.3		4/25/2006	9	Wet	3	n/a
154-08.3		9/18/2006	1	Dry		
154-08.3		9/19/2006	3	Dry		

Station #	Station Name	Date	Results	Wet/Dry	Geomean	90% Reduction
154-08.3		7/29/2008	34	Dry	22.6	40
154-08.3		7/30/2008	15	Dry		
154-09.0		2/15/2000	1.6	Wet	3.9	15
154-09.0		6/7/2000	51	Wet		
154-09.0		9/14/2000	1.7	Wet		
154-09.0		9/19/2000	1.7	Wet		
154-09.0		8/13/2001	51	Wet	5.2	23
154-09.0		8/16/2001	1.6	Dry		
154-09.0		8/21/2001	1.7	Wet		
154-09.0		6/17/2002	3.6	Dry	5.2	n/a
154-09.0		6/18/2002	11	Dry		
154-09.0		9/19/2002	3.6	Dry		
154-09.0		8/20/2003	3.6	Dry	3.6	n/a
154-09.0		7/12/2005	1	Dry	2.2	n/a
154-09.0		7/13/2005	5	Dry		
154-09.0		4/25/2006	8	Wet	3.7	n/a
154-09.0		9/18/2006	3	Dry		
154-09.0		9/19/2006	2	Dry		
154-09.0		7/29/2008	19	Dry	16.9	n/a
154-09.0		7/30/2008	15	Dry		
154-09.0		10/18/2010	14	Dry	5.1	n/a
154-09.0		11/7/2010	2	Dry		
154-09.0		11/21/2010	4	Dry		
154-09.0		12/5/2010	6	Dry		
154-09.0		4/18/2011	9	Wet	6.7	n/a
154-09.0		4/26/2011	5	Dry		
154-09.1		2/15/2000	29	Wet	60.1	23

Station #	Station Name	Date	Results	Wet/Dry	Geomean	90% Reduction
154-09.1		3/22/2000	29	Dry		
154-09.1		6/12/2000	258	Wet		
154-09.1		2/20/2001	18	Dry	18	n/a
154-09.1		5/6/2002	54	Dry	77.1	90
154-09.1		10/28/2002	110	Dry		
154-09.1		9/22/2005	9	Dry	9	n/a
154-09.2		2/15/2000	8.7	Wet	20.2	23
154-09.2		3/22/2000	8.6	Dry		
154-09.2		6/12/2000	110	Wet		
154-09.2		2/20/2001	8.6	Dry	8.7	n/a
154-09.2		12/20/2001	8.7	Dry		
154-09.2		5/6/2002	8.6	Dry	5.6	n/a
154-09.2		10/28/2002	3.6	Dry		
154-09.2		9/22/2005	4	Dry	4	n/a
154-09.3		2/15/2000	54	Wet	49.3	23
154-09.3		3/22/2000	8.6	Dry		
154-09.3		6/12/2000	258	Wet		
154-09.3		2/20/2001	8.6	Dry	8.6	n/a
154-09.3		5/6/2002	70	Dry	87.8	90
154-09.3		10/28/2002	110	Dry		
154-09.3		9/22/2005	9	Dry	9	
154-10.0		2/15/2000	1.7	Wet	6.5	15
154-10.0		6/7/2000	50	Wet		
154-10.0		9/14/2000	5.8	Wet		
154-10.0		9/19/2000	3.6	Wet		
154-10.0		8/13/2001	1.7	Wet	1.7	n/a
154-10.0		8/16/2001	1.7	Dry		

Station #	Station Name	Date	Results	Wet/Dry	Geomean	90% Reduction
154-10.0		8/21/2001	1.6	Wet		
154-10.0		6/17/2002	5.8	Dry	3.1	n/a
154-10.0		6/18/2002	5.8	Dry		
154-10.0		9/17/2002	1.7	Wet		
154-10.0		9/19/2002	1.6	Dry		
154-10.0		8/20/2003	3.6	Dry	3.6	n/a
154-10.0		7/12/2005	2	Dry	2	n/a
154-10.0		7/13/2005	2	Dry		
154-10.0		9/18/2006	1	Dry	3.3	23
154-10.0		9/19/2006	1	Dry		
154-10.0		12/4/2006	37	Dry		
154-10.0		7/29/2008	35	Dry	17.7	40
154-10.0		7/30/2008	9	Dry		
154-10.0		10/18/2010	14	Dry	3.7	n/a
154-10.0		11/7/2010	2	Dry		
154-10.0		11/21/2010	1	Dry		
154-10.0		12/5/2010	7	Dry		
154-10.0		4/18/2011	18	Wet	6	n/a
154-10.0		4/26/2011	2	Dry		
154-10.1		3/22/2000	8.7	Dry	8.7	n/a
154-10.1		2/20/2001	8.1	Dry	8.1	n/a
154-10.1		5/6/2002	41	Dry	45.7	90
154-10.1		10/28/2002	51	Dry		
154-10.1		12/22/2003	23	Dry	23	n/a
154-10.1		9/22/2005	36	Dry	36	90
Shaded cells indicate an exceedance of water quality criteria						

Wet and dry weather geometric mean values for all monitoring stations on segment 2: LIS CB Shore – Westbrook Harbor (East), Westbrook (CT-C2_001)

Station #	Station Name	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
154-08.3		2000-2008	6	11	7.35	11.09	5.88
154-09.0		2000-2011	4	16	4.89	5.90	4.45
154-09.1		2000-2005	2	5	41.4	86.50	30.84
154-09.2		2000-2005	2	6	9.67	30.94	6.56
154-09.3		2000-2005	2	5	35.53	118.03	21.98
154-10.0		2000-2011	8	17	3.96	4.43	3.76
154-10.1		2000-2005	0	6	22.27	n/a	22.27
Shaded cells indicate an exceedance of water quality criteria							

Table 13: Segment 3: LIS CB Shore – Westbrook Harbor (West) Bacteria Data**Waterbody ID:** CT-C2_002**Characteristics:** Saltwater, Class SA**Impairment:** Shellfishing**Water Quality Criteria for Fecal coliform:**

Geometric Mean: 14 colonies/100 ml

90% of Samples Less Than: 31 colonies/100 ml

Percent reduction to meet:

Geometric Mean: 54.25%

90% of Samples Less Than: 40%

*Data: 2000 – 2011 from DA/BA sampling efforts, 2014 TMDL cycle**Single sample fecal coliform data (colonies/100mL) for all monitoring stations on segment 3: LIS CB Shore – Westbrook Harbor (West), Westbrook (CT-C2_002) with annual geometric means and reduction goals for samples.*

Station #	Station Name	Date	Results	Wet/Dry	Geomean	90% Reduction
154-06.1		2/15/2000	5.8	Wet	4.3	n/a
154-06.1		3/21/2000	1.6	Dry		
154-06.1		3/22/2000	8.6	Dry		
154-06.1		2/20/2001	5.8	Dry	5.8	n/a
154-06.1		5/6/2002	8.7	Dry	17.7	40
154-06.1		10/28/2002	36	Dry		
154-07.0		2/15/2000	1.6	Wet	5	n/a
154-07.0		3/21/2000	1.6	Dry		
154-07.0		3/22/2000	8.6	Dry		
154-07.0		6/12/2000	28	Wet		
154-07.0		2/20/2001	1.7	Dry	1.7	n/a
154-07.0		5/6/2002	8.6	Dry	3.8	n/a
154-07.0		10/28/2002	1.7	Dry		
154-07.0		11/24/2003	14	Dry	30.6	40
154-07.0		12/22/2003	67	Dry		
154-07.0		9/22/2005	3	Dry	3	n/a
154-07.0		4/18/2011	10	Wet	22.6	40

Station #	Station Name	Date	Results	Wet/Dry	Geomean	90% Reduction
154-07.0		4/26/2011	51	Dry		
154-08.0		6/7/2000	36	Wet	4.7	23
154-08.0		9/14/2000	1.7	Wet		
154-08.0		9/19/2000	1.7	Wet		
154-08.0		8/13/2001	22	Wet	3.9	n/a
154-08.0		8/16/2001	1.7	Dry		
154-08.0		8/21/2001	1.6	Wet		
154-08.0		6/17/2002	5.8	Dry	4.3	n/a
154-08.0		6/18/2002	8.1	Dry		
154-08.0		9/19/2002	1.7	Dry		
154-08.0		8/20/2003	1.6	Dry	1.6	n/a
154-08.0		7/12/2005	2	Dry	2.8	n/a
154-08.0		7/13/2005	4	Dry		
154-08.0		4/25/2006	1	Wet	1	n/a
154-08.0		9/18/2006	1	Dry		
154-08.0		9/19/2006	1	Dry		
154-08.0		7/29/2008	27	Dry	18.7	n/a
154-08.0		7/30/2008	13	Dry		
154-08.0		10/18/2010	13	Dry	3	n/a
154-08.0		11/7/2010	1	Dry		
154-08.0		11/21/2010	1	Dry		
154-08.0		12/5/2010	6	Dry		
154-08.0		4/18/2011	10	Wet	4.5	n/a
154-08.0		4/26/2011	2	Dry		
Shaded cells indicate an exceedance of water quality criteria						

Wet and dry weather geometric mean values for all monitoring stations on segment 3: LIS CB Shore – Westbrook Harbor (West), Westbrook (CT-C2_002)

Station #	Station Name	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
154-06.1		2000-2002	1	5	7.25	5.8	7.58
154-07.0		2000-2011	3	9	7.28	7.65	6.99
154-08.0		2000-2011	7	16	3.51	4.49	3.15

Table 14: Segment 4: LIS CB Midshore –Westbrook Harbor Bacteria Data**Waterbody ID:** CT-C3_001**Characteristics:** Saltwater, Class SA**Impairment:** Shellfishing**Water Quality Criteria for Fecal coliform:**

Geometric Mean: 14 colonies/100 ml

90% of Samples Less Than: 31 colonies/100 ml

Percent reduction to meet:

Geometric Mean: 26.32%

90% of Samples Less Than: 40%

*Data: 2000 – 2011 from DA/BA sampling efforts, 2014 TMDL cycle**Single sample fecal coliform data (colonies/100mL) for all monitoring stations on segment 4: LIS CB Midshore – Westbrook (CT-C3_001) with annual geometric means and reduction goals for sample*

Station #	Station Name	Date	Results	Wet/Dry	Geomean	90% Reduction
154-06.0		6/7/2000	5.8	Wet	2.5	n/a
154-06.0		9/14/2000	1.6	Wet		
154-06.0		9/19/2000	1.7	Wet		
154-06.0		8/13/2001	22	Wet	6.6	n/a
154-06.0		8/16/2001	3.6	Dry		
154-06.0		8/21/2001	3.6	Wet		
154-06.0		6/17/2002	11	Dry	5.8	n/a
154-06.0		6/18/2002	11	Dry		
154-06.0		9/19/2002	1.6	Dry		
154-06.0		8/20/2003	1.6	Dry	1.6	n/a
154-06.0		7/12/2005	5	Dry	6.3	n/a
154-06.0		7/13/2005	8	Dry		
154-06.0		6/7/2000	5.8	Wet	2.5	n/a
154-06.0		9/14/2000	1.6	Wet		
154-06.0		9/19/2000	1.7	Wet		

Station #	Station Name	Date	Results	Wet/Dry	Geomean	90% Reduction
154-06.0		8/13/2001	22	Wet	6.6	n/a
154-06.0		8/16/2001	3.6	Dry		
154-06.0		8/21/2001	3.6	Wet		
154-06.0		6/17/2002	11	Dry	5.8	n/a
154-06.0		6/18/2002	11	Dry		
154-06.0		9/19/2002	1.6	Dry		
154-06.0		8/20/2003	1.6	Dry	1.6	n/a
154-06.0		7/12/2005	5	Dry	6.3	n/a
154-06.0		7/13/2005	8	Dry		
154-06.0		4/25/2006	5	Wet	2.2	n/a
154-06.0		9/18/2006	2	Dry		
154-06.0		9/19/2006	1	Dry		
154-06.0		7/29/2008	12	Dry	6.9	n/a
154-06.0		7/30/2008	4	Dry		
154-06.0		10/18/2010	17	Dry	4.7	n/a
154-06.0		11/7/2010	1	Dry		
154-06.0		11/21/2010	4	Dry		
154-06.0		12/5/2010	7	Dry		
154-06.0		4/18/2011	14	Wet	14	n/a
154-08.2		6/7/2000	14	Wet	3.3	n/a
154-08.2		9/14/2000	1.6	Wet		
154-08.2		9/19/2000	1.6	Wet		
154-08.2		8/13/2001	1.7	Wet	2.1	n/a
154-08.2		8/16/2001	3.6	Dry		
154-08.2		8/21/2001	1.6	Wet		

Station #	Station Name	Date	Results	Wet/Dry	Geomean	90% Reduction
154-08.2		6/17/2002	11	Dry	4.8	n/a
154-08.2		6/18/2002	8.1	Dry		
154-08.2		9/17/2002	3.6	Wet		
154-08.2		9/19/2002	1.6	Dry		
154-08.2		8/20/2003	1.6	Dry	1.6	n/a
154-08.2		7/12/2005	1	Dry	1.4	n/a
154-08.2		7/13/2005	2	Dry		
154-08.2		4/25/2006	1	Wet	1.3	n/a
154-08.2		9/18/2006	1	Dry		
154-08.2		9/19/2006	2	Dry		
154-08.2		7/29/2008	30	Dry	19.0	n/a
154-08.2		7/30/2008	12	Dry		
154-08.2		10/18/2010	9	Dry	4.9	n/a
154-08.2		11/7/2010	2	Dry		
154-08.2		11/21/2010	4	Dry		
154-08.2		12/5/2010	8	Dry		
154-08.2		4/18/2011	6	Wet	2.4	n/a
154-08.2		4/26/2011	1	Dry		
154-10.2		6/7/2000	50	Wet	9.2	40
154-10.2		9/14/2000	1.7	Wet		
154-10.2		8/13/2001	18	Wet	3.7	n/a
154-10.2		8/16/2001	1.6	Dry		
154-10.2		8/21/2001	1.7	Wet		
154-10.2		6/17/2002	5.8	Dry	3.6	n/a
154-10.2		6/18/2002	11	Dry		
154-10.2		9/17/2002	1.7	Wet		
154-10.2		9/19/2002	1.6	Dry		

Station #	Station Name	Date	Results	Wet/Dry	Geomean	90% Reduction
154-10.2		8/20/2003	1.7	Dry	1.7	n/a
154-10.2		7/12/2005	1	Dry	2.2	n/a
154-10.2		7/13/2005	5	Dry		
154-10.2		4/25/2006	1	Wet	1.4	n/a
154-10.2		9/18/2006	3	Dry		
154-10.2		9/19/2006	1	Dry		
154-10.2		7/29/2008	28	Dry	19.0	n/a
154-10.2		7/30/2008	13	Dry		
154-10.2		10/18/2010	12	Dry	5.8	15
154-10.2		11/7/2010	1	Dry		
154-10.2		11/21/2010	6	Dry		
154-10.2		12/5/2010	16	Dry		
154-10.2		4/18/2011	7	Wet	2.6	n/a
154-10.2		4/26/2011	1	Dry		
Shaded cells indicate an exceedance of water quality criteria						

*Wet and dry weather geometric mean values for all monitoring stations on segment 4: LIS CB
Midshore – Westbrook (CT-C3_001)*

Station #	Station Name	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
154-06.0		2000-2011	7	15	4.44	5.08	4.17
154-08.2		2000-2011	8	16	3.21	2.6	3.57
154-10.2		2000-2011	7	16	3.95	4.38	3.78

Table 15: Segment 5: LIS EB Midshore –Westbrook Bacteria Data**Waterbody ID:** CT-E3_012**Characteristics:** Saltwater, Class SA**Impairment:** Shellfishing**Water Quality Criteria for Fecal coliform:**

Geometric Mean: 14 colonies/100 ml

90% of Samples Less Than: 31 colonies/100 ml

Percent reduction to meet:

Geometric Mean: 62.67%

90% of Samples Less Than: 90%

*Data: 2000 – 2011 from DA/BA sampling efforts, 2014 TMDL cycle**Single sample fecal coliform data (colonies/100mL) for all monitoring stations on segment 5: LIS CB Midshore – Westbrook (CT-E3_012) with annual geometric means and reduction goals for samples.*

Station #	Station Name	Date	Results	Wet/Dry	Geomean	90% Reduction
154-11.2		6/7/2000	3.6	Wet	2.4	n/a
154-11.2		9/14/2000	1.6	Wet		
154-11.2		8/16/2001	8.1	Dry	5.4	n/a
154-11.2		8/21/2001	3.6	Wet		
154-11.2		6/17/2002	5.8	Dry	2.3	n/a
154-11.2		6/18/2002	1.7	Dry		
154-11.2		9/17/2002	1.7	Wet		
154-11.2		9/19/2002	1.7	Dry		
154-11.2		8/20/2003	3.6	Dry	3.6	n/a
154-11.2		7/12/2005	1	Dry	2	n/a
154-11.2		7/13/2005	4	Dry		
154-11.2		4/25/2006	5	Wet	2.5	n/a
154-11.2		9/18/2006	3	Dry		
154-11.2		9/19/2006	1	Dry		
154-11.2		7/29/2008	19	Dry	13.8	n/a
154-11.2		7/30/2008	10	Dry		
154-11.2		10/18/2010	9	Dry	10.5	n/a
154-11.2		11/7/2010	15	Dry		
154-11.2		11/21/2010	10	Dry		
154-11.2		12/5/2010	9	Dry		
154-11.2		4/18/2011	10	Wet	7.1	n/a
154-11.2		4/26/2011	5	Dry		
154-43.0		6/7/2000	28	Wet	7.3	n/a
154-43.0		9/14/2000	1.7	Wet		
154-43.0		9/19/2000	8.1	Wet		

Station #	Station Name	Date	Results	Wet/Dry	Geomean	90% Reduction
154-43.0		8/13/2001	28	Wet	6.5	n/a
154-43.0		8/16/2001	5.8	Dry		
154-43.0		8/21/2001	1.7	Wet		
154-43.0		6/17/2002	22	Dry	6.3	n/a
154-43.0		6/18/2002	28	Dry		
154-43.0		9/19/2002	1.6	Dry		
154-43.0		9/30/2002	1.6	Dry		
154-43.0		8/20/2003	1.6	Dry	1.6	n/a
154-43.0		7/12/2005	44	Dry	37.5	90
154-43.0		7/13/2005	32	Dry		
154-43.0		4/25/2006	1	Wet	1	n/a
154-43.0		9/18/2006	1	Dry		
154-43.0		9/19/2006	1	Dry		
154-43.0		7/29/2008	13	Dry	8.1	n/a
154-43.0		7/30/2008	5	Dry		
Shaded cells indicate an exceedance of water quality criteria						

Wet and dry weather geometric mean values for all monitoring stations on segment 5: LIS CB Midshore – Westbrook (CT-E3_012)

Station #	Station Name	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
154-11.2		2000-2011	6	16	4.36	3.48	4.75
154-43.0		2000-2008	6	12	5.55	5.14	5.76

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DOCUMENT REVISION HISTORY: ESTUARY 15 WESTBROOK TMDL

February 2019: This is a new document, not a revision. 5 segments are included in this TMDL, all impaired for Shellfishing due to high levels of bacteria.

Date	Segments covered: impaired designated use
February 2019	CT-C1_001: Shellfishing CT-C2_001: Shellfishing CT-C2_002: Shellfishing CT-C3_001: Shellfishing CT-E3_012: Shellfishing